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The Recent Mediterranean species of the genus *Pyrunculus* Pilsbry, 1895 (Opisthobranchia, Cephalaspidea, Retusidae)

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KEY WORDS: Retusidae; *Pyrunculus*; systematics; morphology; North-eastern Atlantic; Mediterranean; marine; Recent.

ABSTRACT The present work is an attempt to update the check-list of the Mediterranean species of *Pyrunculus* Pilsbry, 1895. The species have been ascribed to the genus on the base of: (a) the small sized bubble-shell, characteristically peat-shaped; (b) the gizzard plates (three), subtriangular in shape, corneous, light brown colouted, with two darker blunt tubercles. Three members of the genus are considered as present in the Mediterranean Sea: *Pyrunculus ovatus* (Jeffreys *in* W.B. Carpenter & Jeffreys, 1871), *P. hoernesii* (Weinkauff, 1866), and *P. fourierii* (Audouin, 1827). *P. ovatus* is still living in the Atlantic, but is possibly extinct in the Mediterranean waters. *Cylichna obesiuscula* Brugnone, 1877, is regarded as a form of *P. ovatus*, as probably is also *Cylichna obscura* Sykes, 1904. The view of TRINGALI (1993) that *Cylichna hoernesii* Weinkauff, 1866, should be assigned to *Pyrunculus* is confirmed. *Cylichna cuneata* Tiberi, 1868, is a synonym of *P. hoernesii*. *Bulla fourierii* Audouin, 1827, usually included in *Retusa*, is assigned to *Pyrunculus* basing on its gizzard plates. The shell morphology itself does not allow to give this systematic position. The species is a Lessepsian migrant, apparently well-acclimatised in the Levant Sea, and widespread through the Indo-Pacific waters. There are other more recent names possibly available for *P. fourierii*: *Bulla decussata* A. Adams, 1850, *Utriculus simillimus* R.B. Watson, 1883, *Cylichna protumida* Hedley, 1903, all to be checked on the type material. The statement by BOGI & KHAIRALLAH (1987) that the Tunisian *Retusa dilatata* Pallary, 1904, and its variety *minor* Pallary, 1904, are synonyms of *P. fourierii*, is rebutted. *Utriculus minutissimus* Monterosato, 1878, considered by several workers as a *Pyrunculus*, must be removed from this genus, being a *Retusa*, as shown by both the shell and the gizzard plates morphology.

RIASSUNTO Questo lavoro presenta un tentativo di aggiornamento della lista delle specie mediterranee appartenenti al genere *Pyrunculus* Pilsbry, 1895. Le specie sono state attribuite al genere tenendo conto di due caratteristiche: (a) la piccola conchiglia bulliforme e tipicamente piriforme; (b) le tre piastre gastriche – situate in un'espansione dell'esofago che potrebbe essere chiamata, più specificamente, ventriglio (ingl. "gizzard"), per analogia con l'organo degli uccelli, funzionale al trattenere e frantumare i nicchi calcarei delle prede (foraminiferi per le specie di *Pyrunculus*) - subtriangolari, cornee, di colore bruno chiaro, con due soli noduli, di colore bruno scuro. Le piastre gastriche del genere *Retusa* T. Brown, 1827, assai prossimo, sono simili, ma presentano numerosi noduli sulla superficie, e di minori dimensioni. Tre specie vengono qui considerate presenti in Mediterraneo: *Pyrunculus ovatus* (Jeffreys in W.B. Carpenter & Jeffreys, 1871), *P. hoernesii* (Weinkauff, 1866), and *P. fourierii* (Audouin, 1827). Non è ancora chiaro se il primo sia reperibile in Mediterraneo soltanto come fossile pleistocenico, mentre è certamente vivente in Atlantico. *Cylichna obesiuscula* Brugnone, 1877, è considerata una forma di *P. ovatus*, così com'è assai probabilmente anche *Cylichna obscura* Sykes, 1904. Viene confermata l'attribuzione a *Pyrunculus* di *Cylichna hoernesii* Weinkauff, 1866, proposta da TRINGALI (1993). *Cylichna cuneata* Tiberi, 1868, è un sinonimo. *Bulla fourierii* Audouin, 1827, in genere attribuita a *Retusa*, è da spostare in *Pyrunculus*, in base alle piastre gastriche. Va rilevato come la morfologia conchiliare della specie non suggerisca, per se stessa, l'attribuzione a questo genere. *P. fourierii* è un immigrante lessepsiano, largamente diffuso nell'Indo-Pacifico, avendo a disposizione anche altri nomi - *Bulla decussata* A. Adams, 1850, *Utriculus simillimus* R.B. Watson, 1883, *Cylichna protumida* Hedley, 1903, tutti, però, da verificare definitivamente sul materiale tipico. Contrariamente a quanto indicato da BOGI & KHAIRALLAH (1987), la tunisina *Retusa dilatata* Pallary, 1904, e la sua varietà *minor* Pallary, 1904, non sono sinonimi di *P. fourierii*, ma piuttosto entità correlate a *Retusa truncatula* (Bruguière, 1792), forse semplici forme giganti di quest'ultima, con altezza fino a 7 mm circa. La presenza di *P. fourierii* in Mediterraneo, perciò, sembra limitata al bacino di Levante, non raggiungendo le acque della Tunisia. *Utriculus minutissimus* Monterosato, 1878, considerato da vari autori quale membro di *Pyrunculus*, deve essere rimosso da questo genere, essendo una *Retusa*, come mostra la morfologia conchiliare, e conferma la forma delle piastre gastriche.

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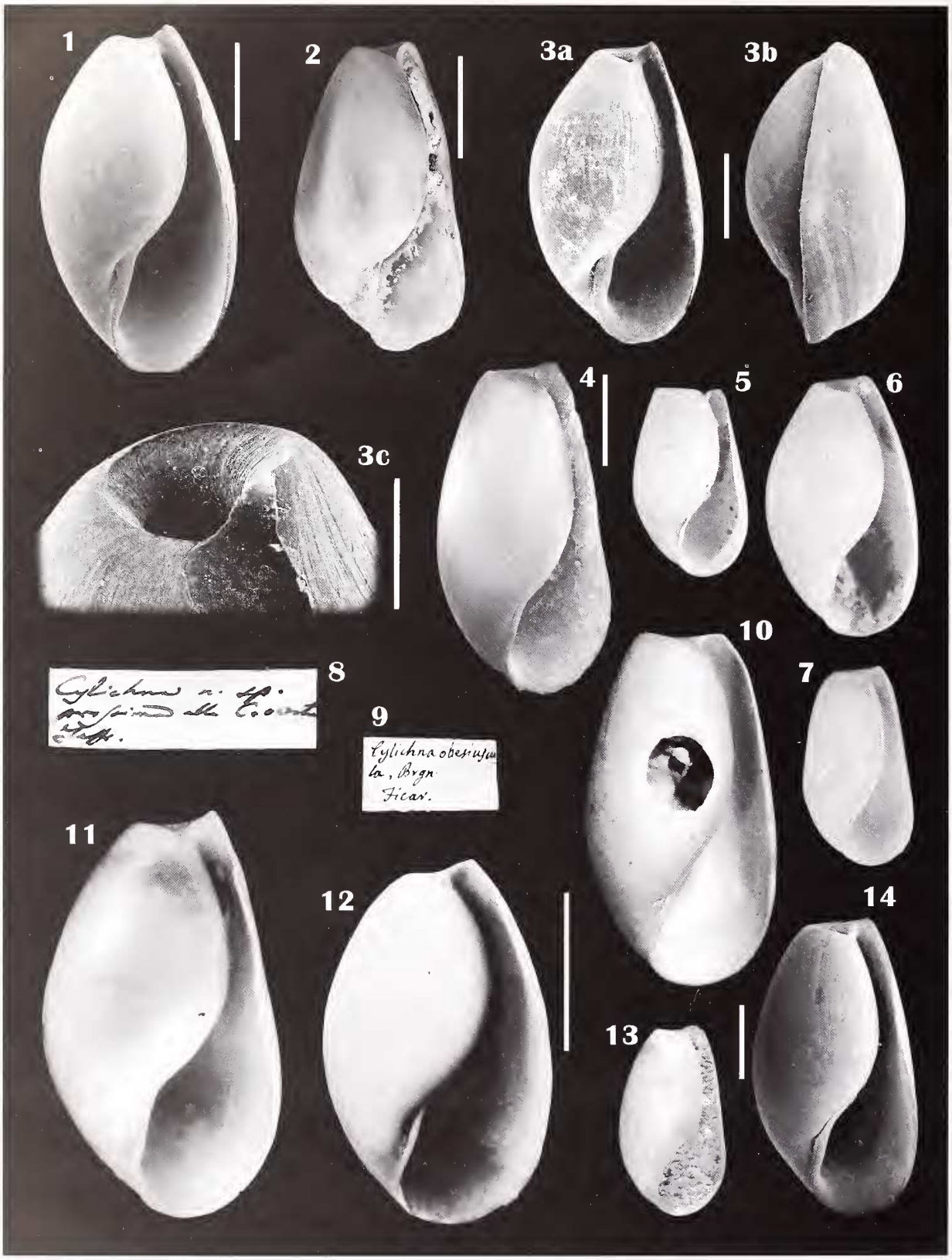
INTRODUCTION

The Eastern Atlantic and Mediterranean gastropods belonging to the order Cephalaspidea P. Fischer, 1883 [= Bullomorpha Pelseneer, 1906], have obtained little attention by malacological research, thus their systematics and nomenclature are poorly known.

The aim of the present report is to update the check-list of the Mediterranean species of the genus *Pyrunculus* Pilsbry, 1895. We nevertheless advise the readers not to regard this as a full systematic review of such a scarcely known group of species. The data available to us are still rather scanty, based on hard parts only, i.e. shell and gizzard plates. Moreover several questions remain still unanswered. Our provisional conclusions are, however, somewhat diverging from those proposed by the other lists of Mediterranean species of the genus, with emendatio, addenda, changes of systematic position and newly proposed synonymies.

Abbreviations and acronyms

AMS: Australian Museum, Sydney, Australia;
coll./colls.: collection/collections;
frg./frgs.: shell fragment/fragments;
leg.: collected by (after Latin: "legit");
LPT: Lionello Paolo Tringali, Rome;
MNHN: Museum National d'Historie Naturelle, Paris, France;
MO: Marco Oliverio, Dip. Biologia Animale e dell'Uomo, "La Sapienza" Roma-I University, Rome;
NHML: Natural History Museum, London, U.K.
sh./shs.: specimen/specimens collected without soft parts;
spm./spms.: specimen/specimens collected with the soft parts;
USNM: United States National Museum, Smithsonian Institution, Washington, U.S.A.
ZMR: (Township) Zoological Museum, Rome, ("Museo Civico di Zoologia, Roma"), Italy.



Figs. 1-14. *Pyrunculus ovatus* (Jeffreys) - **Figs. 1, 2, 3a-c**: syntypes of *Cylichna obesiuscula* Brugnone, Ficarazzi (Palermo, Sicily) (Monterosato coll.); **Figs. 4-7**: "Princesse Alice" exp. (1895), Stn. 46, 1385 m (Monterosato coll.) (Figs. 5, 6, 7 respective h: 3.3, 3.0, 3.6, 2.9 mm); **Fig. 8**: original label by Monterosato noticing that the swollen form would be a new species, similar to *P. ovatus*; **Fig. 9**: original label of *Cylichna obesiuscula* by Brugnone; **Fig. 10**: "Triton" exp. (1881), Stn. 13, 555 fathoms (= 1026 m ca.), off North Great Britain (h: 3.2) (Monterosato coll.); **Fig. 11**: Mauritania, fishing net residue, 900-1200 m (h: 3.4 mm) (F. Gubbioli leg.); **Fig. 12**: "De Profundis" Project (1991 exp.), Stn. DP91-4, East Sardinia, 571-347 m; **Figs. 13-14**: "Talisman" exp. (1883), Stn. 127, Azores, between Pico and St. Georges, 1258 m (Monterosato coll.) (Fig. 13 h.: 3.1 mm) - **Scale bars**: 2.0 mm (2); 1.0 mm (1, 3a, 3b, 4, 12, 14); 400 µm (3c).

Some general remarks on *Pyrunculus*

Pyrunculus PILSBRY, 1895 (: 181, 229), was proposed as a new name to replace *Sao* H. Adams & A. Adams, 1854 [non Bilberg, 1820, nec Barrande, 1846, nec Kölliker, 1853], thus acquiring the same type species, namely the Chinese *Bulla pyriformis* A. Adams, 1850, by monotypy (ADAMS & ADAMS, 1854: 21). Adams brothers introduced *Sao* as a subgenus of *Atys* Montfort, 1810, whereas PILSBRY (1895: 181) provisionally regarded *Pyrunculus* as a subgenus of *Retusa* T. Brown, 1827. The position in the family Retusidae Thiele, 1931, is widely accepted nowadays.

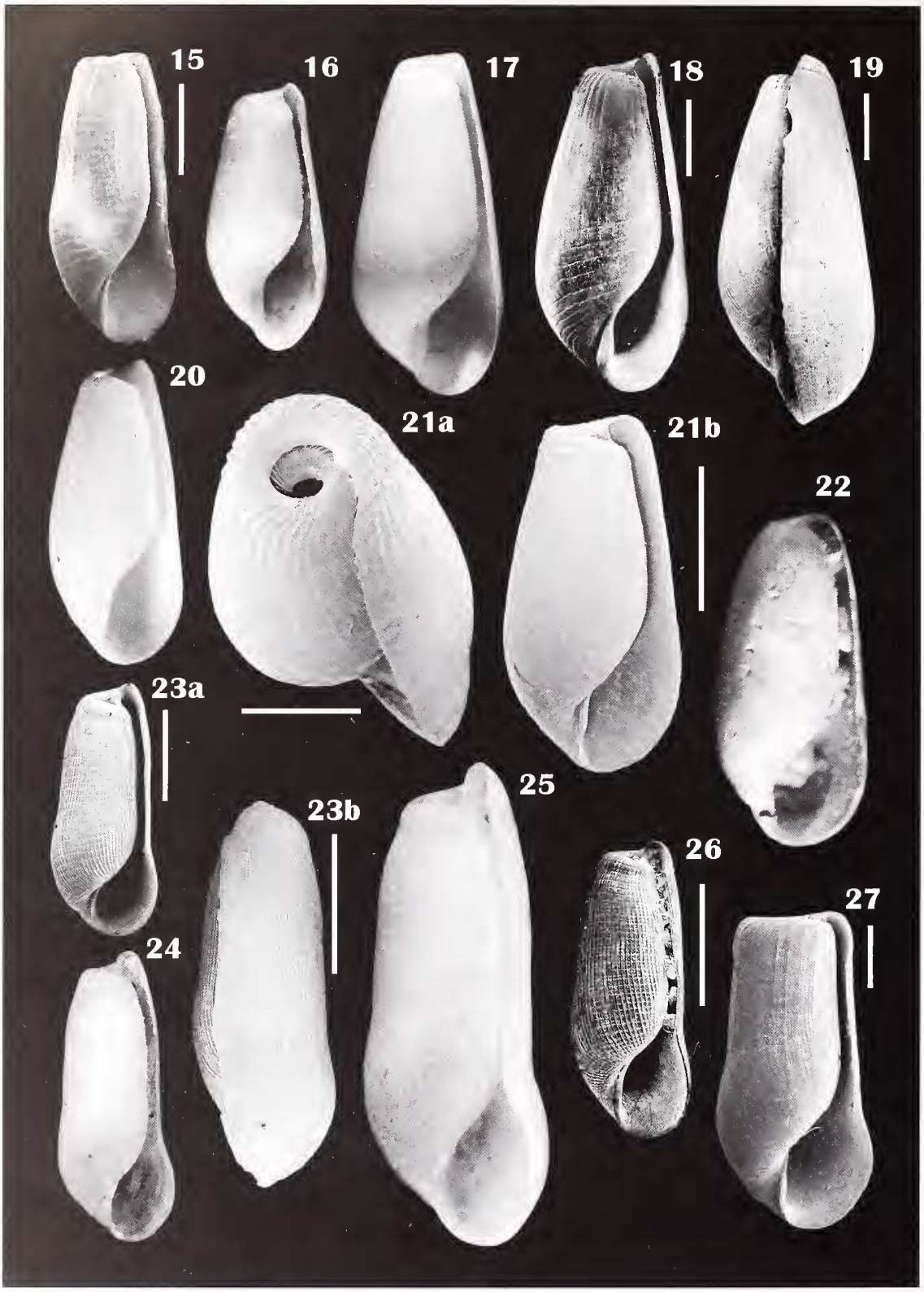
Sao pyriformis has a distinctly pear-shaped (= pyriform) shell, which gradually swells downward, and has a deeply sunken spire, barely visible through the apical umbilicus. For a long time *Sao/Pyrunculus* species were simply identified on account of the pear-shaped outline of the shell (PILSBRY, 1895: loc. cit.). In the twentieth century it became evident that the gizzard plates add a further feature to identify them (THIELE, 1931: 389; BOUCHET, 1975: 333). The anterior digestive tract of the members of *Pyrunculus* includes a gizzard with three small corneous plates, employed to enclose preys – as far as it is known, foraminifers - and/or to crush their tests. The plates are reminiscent of those of the genus *Retusa*, nearly triangular in shape, slightly curved, light brown coloured with darker tubercles; however each plate of *Pyrunculus* bears two tubercles only (Figs. 35-37) whereas on the plates of *Retusa* there are several smaller tubercles spread on the plates' surface. Data on the gizzard plates of some species of *Retusa* have been already gathered in literature since nineteenth century, e.g.: *Retusa truncatula* (Bruguière, 1792) (SARS, 1878: anatomical pl. XI, fig. 8; PILSBRY, 1895: pl. 60, fig. 4; VAYSSIÈRE, 1934: fig. 6; THOMPSON, 1976: 114; LUQUE, 1983: 54, fig. 2b; also personal observations on material from Southern Turkey and Mediterranean Morocco), *Retusa nitidula* (Lovén, 1846) (SARS, 1878: anatomical pl. XI, figs. 6a-b; PILSBRY, 1895: pl. 60, figs. 6-7), *Retusa sosa* MARCUS & MARCUS, 1969 (: 7; 5, fig. 7), *Retusa pelyx* Burn in BURN & BELL, 1974 (: 38; 39, fig. 4), *Retusa obtusa* (Montagu, 1803) (SARS, 1878: anatomical pl. XI, fig. 9, as «*Utriculus pertenuis* (Mighels, 1842)»; SMYTHE, 1979: 96-97; pl. IV, fig. 13; MIKKELSEN, 1996: 391, fig.30); *R. tarutana* SMYTHE, 1979 (: pl. 4, fig. 13); *Retusa umbilicata* (Montagu, 1803) (SARS, 1878: anatomical pl. XI, fig. 7; PILSBRY, 1895: pl. 60, fig. 8). Additionally we noticed the same gizzard plates morphology for *Retusa desgenettii* (Audouin, 1827) (Figs. 39a-b), *Retusa mamillata* (Philippi, 1836) (Figs. 38a-b) and *Retusa minutissima* (Monterosato, 1878) (see OLIVERIO & TRINGALI, 2001, this Volume: figs. 43a-b) after material from Sudan, Southern Turkey, and Southeast Spain, respectively. Traditionally *Pyrunculus* and *Retusa* have been regarded as closely related, a view we share, with *Pyrunculus* as a distinct genus within the same family, also considering other retusid genera – such as *Relichna* Rudman, 1971, – are regarded as distinct according to the gizzard plates morphology.

It is not always easy to recognise members of these genera on the basis of the shell morphology. A somewhat pear-shaped shell may be also found in some species of *Retusa*, albeit usually with a more marked recess just above the half of the height. Other shell features – sculpture, colour, shape of the top, etc. – do not seem unfailing as distinctive traits. *Pyrunculus* species lack a radula and jaws structures (e.g. BOUCHET, 1975: 332; MORENO & TEMPLADO, 1998: 48), as is typical of retusid gastropods, including *Retusa*. We had not access to properly fixed material of any species, yet fresh dead retusids may still keep the corneous plates even if the soft parts are reduced to few poor residues inside the shell. Thus, we have been able to examine and photograph the gizzard plates of all the species discussed in the following notes. Therefore, we have adopted as criteria to identify *Pyrunculus* species those traditionally accepted: (a) the shell morphology, with special attention to the pear-shaped outline; (b) the gizzard plates morphology, considering this latter as a decisive character. Shells of some species may lack a marked pear-shaped outline, yet they are linked with others, more typically pear-shaped, forming a continuum, thus arguably falling within the morphologic range of a single species.

The Mediterranean species

Pyrunculus is distributed world wide, however the number of species is hard to evaluate, even roughly, as it is likely that some species are usually quoted in molluscan check-lists under other genera or families – e.g. *Cylichna* Lovén, 1846, *Retusa*, etc. – and, moreover, it is likely that there are species still awaiting a description, especially in the Indo-Pacific waters (cf. CEDHAGEN, 1997). PILSBRY (1895: 229-233) listed 10 *Pyrunculus* species, yet it may be reasonably argued that the actual representatives of *Pyrunculus* are more numerous. The number of Mediterranean species usually ascribed to the genus is low. The last printed catalogue of Mediterranean molluscs, namely SABELLI et alii (1990-1992: 53, 230, 424), lists 2 species, namely «*Pyrunculus ovatus* (Jeffreys, 1871)» and «*Pyrunculus minutissimus* (Monterosato, 1878)». In the past other *Pyrunculus* species were quoted for the Mediterranean. LOCARD (1897: 71; 1905: 56) recorded *Cylichna obesiuscula*, erroneously ascribed to Monterosato, who never quoted this species in his works, the actual authorship of this name being by BRUGNONE (1877). *Cylichna obesiuscula* had been introduced for Sicilian fossil material, being already ascribed to *Pyrunculus* by PILSBRY (1895: 231-232) together with *Cylichna ovata* Jeffreys (which we regard as conspecific, see below). Recently, one of the writers (TRINGALI, 1993: 26) noticed that *Bulla hoernesii* Weinkauff, 1868, usually included in *Cylichna*, is a *Pyrunculus*.

We consider that three species are known for the Mediterranean Sea: *Pyrunculus ovatus* (Jeffreys in W.B. Carpenter & Jeffreys, 1871), *P. hoernesii* (Weinkauff, 1866), and *P. fourierii* (Audouin, 1827), the former possibly being extinct in the Mediterranean, where only empty shells have been found within deep-water sediments. *Pyrunculus fourierii* is an Indo-Pacific species, inhabiting the Eastern Mediterranean as a Lessepsian migrant. These species and their synonymies are briefly commented in the following notes. *Utriculus minutissimus* MONTEROSATO, 1878 (: 159-160), included in this genus by NORDSIECK (1972: 36; 237, fig.15), and later checklists (PIANI, 1980: 159; BRUSCHI et alii, 1985: 33; SABELLI et alii, 1990-92: 53, 230, 424; BEDULLI et alii, 1995: 6), must be removed from *Pyrunculus*. It is actually a *Retusa*, according to the evenly cylindrical shell with flat or protruding spire (Figs. 34a-b), and the gizzard plates typical of the genus (for a more detailed discussion on *Retusa minutissima* see OLIVERIO & TRINGALI, 2001, this Volume). It is likely that the above mentioned authors were misled by NORDSIECK (1972), who figured under *Utriculus minutissimus* an apparent *Pyrunculus*, which, however, does not fit the original description and type material.



Figs. 15-27. Retusid shells - **Fig. 15:** *"Pyrunculus"* sp., (Tertiary ?) Fossil deposits of Altavilla Milicia (Palermo, Sicily), (identified by Monterosato as *«Coleophysis* [illegible] n. sp.») (Monterosato coll.). **Figs. 16-21:** *P. hoernesii* (Weinkauff) – **Fig. 16:** syntype, Algiers (Algeria), unrecorded depth (Monterosato coll.) (h.: 2.8 mm); **Figs 17-20:** material labelled as *«Cylichna cuneata»* by Tiberi (**Figs. 17-19:** Gulf of Naples, unrecorded depth. (Fig. 17 h: 5.6 mm); **Fig. 20:** Taranto, (Southeast Italy, Pleistocene deposits) (h.: 3.7 mm) (Monterosato coll.); **Fig. 21a-21b:** West Sahara, between 24°-25° N. lat., 40-50 m, from stomach of sole fishes (F. Gubbioli leg.). **Fig. 22:** *"Retusa"* sp., labelled as *«Cylichna conuloides* S. Wood» by R.B. Watson, Suffolk (U.K.), coralline crag Fossil deposits (Monterosato coll.) (h.: 3.2 mm). **Figs.** 23-26: *P. fourierii* (Audouin) – **Figs. 23a-b, 24, 25:** Soguksu (Aydincik, South Turkey), 9-10 m *Posidonia oceanica* intermatte's sediment (RV leg.) (Figs. 24-25 respective h: 3.0; 3.2 mm); **Fig. 26:** Northern coast of Green Is. (Cairns, Queensland), coral reef sediment 3-4 m (C. Schander leg.). **Fig. 27:** *Retusa dilatata* Pallary, syntype, Sfax, (Tunisia) (P. Pallary leg., Monterosato coll.) - **Scale bars:** 1.0 mm (15, 18, 19, 21b, 23a-b, 26, 27); 500 µm (21a).

Pyrunculus ovatus **(Jeffreys in W.B. Carpenter & Jeffreys, 1871)**
(Figs. 1-14, 33, 35a-b, 45)

- *Bulla conulus* Deshayes, 1824, sensu Auctores
- *Cylichna umbilicata* var. "*conulus*" Jeffreys, 1867 (: 414-415)
- *Cylichna ovata* Jeffreys in W.B. Carpenter & Jeffreys, 1871 (: 156)
- *Cylichna obesiuscula* Brugnone, 1877 (: 39-40; pl. 1, fig. 7)
- (?) *Cylichna obscura* Sykes, 1904 (: 37; pl. III, figs. 9-9a)

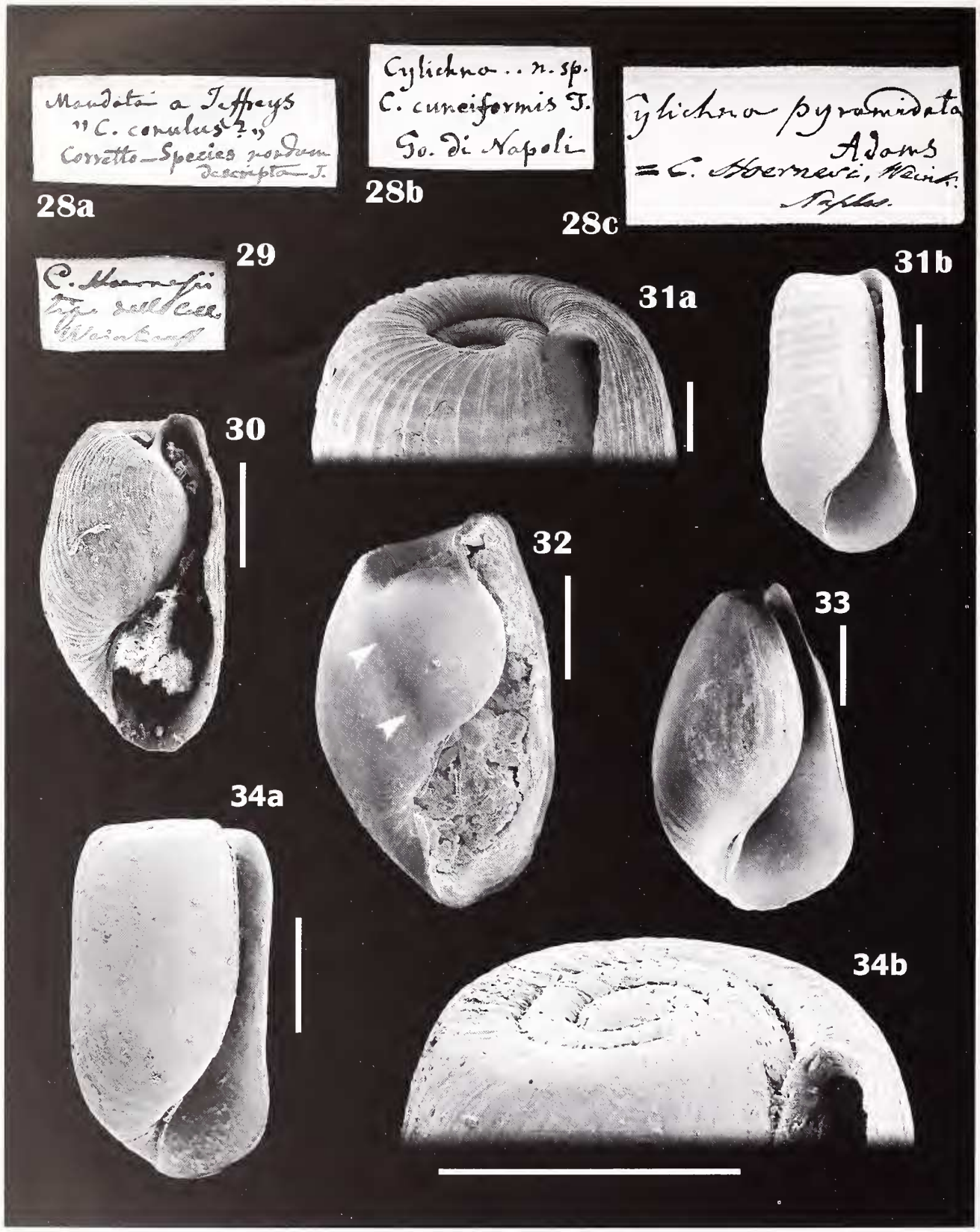
Material examined - Type material: *Cylichna ovata*, not examined; «holotype» figured by Warén (1980: pl. 6, fig. 14) (USNM). *Cylichna obesiuscula*, Ficarazzi (Palermo, Sicily, probably Pleistocene), 1 sh. (syntype), (Monterosato coll., box 16142, ZMR); Ficarazzi (Palermo, Sicily, probably Pleistocene), 207 shs. + 2 frgs. (syntypes), (Monterosato coll., box 16121, ZMR); Mt. Pellegrino (Palermo, Sicily, probably Pleistocene), 2 shs. (syntypes) (Monterosato coll., box 16142, ZMR). *Cylichna obscura*: not examined (probably in the NHML). **Other material:** Mediterranean Sea: Oran (Algeria), unrecorded depth, 1 sh. (P. Pallary leg., Monterosato coll., box 16335, ZMR); "De Profundis" Cruise (1991), Stn. DP91-4, Eastern Sardinia, 571-347 m, over a hundred shs. (cf. Bonfitto et alii, 1994: 148; 156, fig. 25); Terracina (Latina, West Italy), 600 m, muddy residuals inside a Roman amphora, 1 sh. (Roberto Ardovini coll., Rome). Northeast Atlantic: "Triton" exp. (1881) between the Hebrides and Faeroes Islands, Stn. 13, 555 fathoms, 2 shs., (Monterosato coll., box 16102, ZMR); "Princesse Alice" exp. (1895), Stn. 46, 1385 m, 50 shs. (labelled by Dautzenberg, Monterosato coll., box 16102, ZMR); "Talisman" exp. (1883), Stn. 127, Azores, between Pico and St. Georges., 1258 m, 18 shs. + 1 frg. (probably sent by A. Locard, Monterosato coll., box 16102, ZMR); Mauritania, from fishing net residual, 900-1200 m, 1 partly preserved spm. (Franco Gubbioli coll., Marbella). Italian fossil deposits: Rometta (Southwest Italy, probably Pleistocene), 2 shs. identified by Brugnone as «*Cylichna obesiuscula*» (Monterosato coll., box 16142, ZMR); Castellace, (Southwest Italy, probably Pleistocene), Lower Pleistocene deposit near the Boscaino Torrent, , 1 sh. (LPT coll., Rome)

Remarks - This species has been frequently misidentified, especially in the nineteenth century, as *Bulla conulus* Deshayes, 1824 (: 41; pl. V, figs. 34, and 36), an Eocene-Miocene *Pyrunculus* species of the Paris basin, although the latter has spiral lines on the basis, lacking on *P. ovatus*, and a more slender outline. The first author who recognised this entity as distinct was Jeffreys (1867), who described it as a simple var. "*conulus*" of *Retusa umbilicata* (Montagu, 1803), underlying, however, that he considered this variety as distinct from *Bulla conulus* Deshayes. Later on, however, Jeffreys in W.B. Carpenter & Jeffreys (1871) introduced the name *Cylichna ovata* by means of a vague reference to «*Bulla conulus*, S. Wood, not Deshayes (Coralline Crag)». It is actually difficult to identify the fossil shells from Sutton (Britain) described and figured by Wood (1848: 173-174; pl. XXI, figs. 2a-c) under the name *Bulla conulus* Deshayes, with the present species. Possibly Wood's shells – not examined by us - are not the same of *P. conulus*, but they show a fine spiral sculpture all over the shell which should not apply to *P. ovatus*, and a more rounded top. We have examined three shells from the Coralline Crag deposits of Suffolk (Britain) labelled as «*Cylichna conuloides* S. Wood» by R.B. Watson (Monterosato coll., box 16122, ZMR), which could match better Woods' material, looking closer some *Retusa* species with sunken spire (Fig. 22). According to the ICZN (1999: Art. 72.4)) the material on which the drawing and description by Wood are based attained the status of type material of the new species along with the original material in Jeffreys' hands when the new species was recognised. Nevertheless Warén (1980: 36; pl. 6, fig. 14) considered as the «holotype» of *P. ovatus* the single shell from Deal Voe (Shetland Islands) in the Jeffreys coll.(USNM, no. 175405) thus making a valid selection of a lectotype (ICZN, 1999: Art. 74.6). Since the shells of Wood may prove not conspecific with the Quaternary *P. ovatus*, this designation would stabilise usage of *P. ovatus*.

Pyrunculus ovatus is an amphiatlantic gastropod, moderately common on muddy bottoms in deep waters. This species has been recorded by several authors for the Northeast Atlantic (e.g. Dautzenberg, 1889: 23; Jeffreys, 1883: 393; Locard, 1897: 69-71) being also known for the Northwest side (e.g. Dall, 1889: 86; Verrill, 1881: 382, as «*Diaphana conulus* (Deshayes)»; Watson, 1886: 664; pl. XLIX, fig. 9). It is a member of the Atlantic fauna, whereas it has never been recorded alive in the Mediterranean, where records are probably based on late Pleistocene fossils only. The first Mediterranean record was by Jeffreys (1882: 34), based on material collected by the Italian Vessel "Washington" (1881 exp.) in the Central Mediterranean basin. Also the old Mediterranean record of *Cylichna obesiuscula* Brugnone by Locard (1897: 71; 1905: 56) after a single shell from off Marseille (South France) is to ascribe to *P. ovatus* (*Cylichna obesiuscula* is a swollen form of *P. ovatus*). More recently, Bonfitto et alii (1994: 148; 156, fig. 25) figured and identified as «*Pyrunculus* sp.» a lot of swollen shells of *P. ovatus* collected by the R/V "Bannock" ["De Profundis" 1991 expedition, Stn. DP91-4, East Sardinia, 571-347 m].

The shell is by far the most variable in shape of all the Mediterranean *Pyrunculus*. In the typical form, as represented by the lectotype, the outline is evenly conical, with nearly flat sides, and a broad base. The maximum diameter is at about the lower third of the height; yet there are shells with the maximum diameter closest to the base, and others more swollen in the middle, thus with evenly rounded sides. Those more oval shells may, moreover, display a variable outline, from slender to somewhat stumpy. Also the spire may vary: it is usually deeply sunken, with a narrow apical umbilicus; however, the latter, may be occasionally larger, clearly displaying the spire in upper view. The apical umbilicus is always encircled by a marked ridge. The columella may bear a weak fold, which is usually lacking. The shell surface is nearly smooth, moderately shining on fresh shells, and occasionally also on fossil ones. It is sculptured by weak growth lines only, lacking any spiral sculpture.

Cylichna obesiuscula Brugnone seems to fall within the morphological range of *P. ovatus*, representing the more rounded, egg-shaped and swollen form, linked to the typical, pear-shaped form by all intermediates. Traditionally, *Cylichna obesiuscula* has been regarded as a full valid species (Jeffreys fide Brugnone, 1877; Monterosato in schedis, cf. Locard, 1897: 71; Seguenza, 1880: 252; Dall, 1889: 86; Pilsbry, 1895: 231-232; Locard, 1897: 69-71, 1905: 56; Bouchet, 1975: 334). However, examining a large number of shells, a different view arises. The rich lot of syntypes from Ficarazzi shows a predominance of swollen shells with rounded sides, yet it contains a wide range of forms, including intermediates to typical *P. ovatus*. Therefore *Cylichna obesiuscula* seems to be a form of *P. ovatus*. The couple of shells from the "Triton" exp. (1881), Stn. 13, are not labelled by Jeffreys, although arguably they were sent by the British malacologist himself to Monterosato as representatives of



Figs. 28a-c: original labels of *Cylichna cuneata* Tiberi. **Fig**. 29: label by Monterosato for the syntype of *P. hoernesii* (Weinkauff). **Fig**. 30: *P. fourierii* (Audouin), juvenile shell, Soguksu (Aydincik, Turkey), *Posidonia oceanica* intermatte's sediment 10 m (RV leg.). **Figs**. 31a-b: *Retusa desgenettii* (Audouin), Marsa Fijab (Sudan), beached (MO leg.). **Fig**. 32: *P. hoernesii* (Weinkauff), juvenile shell, West Sahara, between 24°-25° N. lat., 40-60 m (F. Gubbioli leg.) (arrows point to the protoconch-teleoconch boundary). **Fig**. 33: *Pyrunculus* ovatus, syntype of *Cylichna obesiuscula* Brugnone, Ficarazzi (Palermo, Sicily) (Monterosato coll.).**Figs**. 34a-b: *Retusa minutissima* (Monterosato), Paleohora, Crete, bioclastic sand sample 10 m (S. Farinelli leg.) - **Scale bars**: 1.0 mm (33); 500 µm (31b, 34a-b); 200 µm (30, 31a, 32).

P. ovatus (JEFFREYS, 1883: 393, lists this species from Stn. 13). Anyway, they cannot be regarded as type material, having been collected after the original introduction of the species. These shells belong to a slender oval form, observed also within the material from the "Princesse Alice" exp. (1895), as well as within the type material of *Cylichna obesiuscula*. As *C. obesiuscula*, this form is not truly pear-shaped, being somewhat oval, and would be characterised by a more slender outline and a slightly broader apical umbilicus. We find, however, that also this form belongs to the morphological range of *P. ovatus* as an extreme. Arguably it is the same of the Northeast Atlantic *Cylichna obscura* Sykes, 1904, described from the "Porcupine" exp. (1869-1870) Stn. 3. Since we have not examined the relevant type material, we prefer to keep a provisional question mark on the synonymy with *P. ovatus*.

The gizzard plates of *P. ovatus* were described and sketched by BOUCHET (1975: 333, figs. 6b-c). We have examined two paired plates only from partially preserved dry residuals of a West African specimen (Figs. 35a-b); the unpaired plate was already lost by the damaged specimen. Both are typical *Pyrunculus* paired plates. BOUCHET (1975: 332) noticed that *P. ovatus* feeds on Foraminifera as most of the carnivorous cephalaspideans (cf. CEDHAGEN, 1996). Thus it was not surprising to find several foraminiferan tests (exemplified in the Figs. 40-44), inside the dry residuals of the gizzard of our specimen.

Pyrunculus hoernesii **(Weinkauff, 1866)**
(Figs. 16-21, 32, 37a-b, 46, 50a-c)

- *Bulla striatula* Forbes, 1844 sensu Auctores
- *Bulla conulus* Deshayes, 1824, sensu WEINKAUFF (1862: 337)
- *Bulla (Cylichna) hoernesii* WEINKAUFF, 1866 (: 238)
- *Cylichna cuneata* TIBERI, 1868 (: 180)

Material examined - Type material: *Bulla hoernesii*: Alger (Algeria), unrecorded depth, 1 sh. (syntype) (ex Weinkauff coll., Monterosato coll., box 16118); further material probably in the USNM, not examined. *Cylichna cuneata*: not identifiable (see below). **Other material:** Mediterranean Sea: Terracina (Latina, West Italy), muddy residue from fishing net, 300 m depth, 1 sh. (Roberto Ardovini coll., Rome); Gulf of Naples, 223 shs./spms./frgs. labelled as «*Cylichna* n. sp., *Cylichna cuneiformis* T., Go. di Napoli» by Tiberi (Monterosato coll., box 16118; see Figs. 28a-c); Capri Is. (Naples, Southwest Italy), 1 sh. (Monterosato coll., box 16118); Palermo (West Sicily), 22 shs. (Monterosato coll., box 16028); Cape San Vito (West Sicily), 25 shs./spms. (Monterosato coll., box 16118); Vendicari Is. (West Sicily), bioclastic sand sample 30 m, 1 sh. (LPT coll., Rome); Algiers (Algeria), 28 shs./spms. (P. Joly leg., Monterosato coll., box 16118); Oran (Algeria), 2 shs. (P. Pallary leg., Monterosato coll., box 16335); Cala Iris (Torres de Alcalá, North Morocco), bioclastic sand sample 2-10 m, 8 shs./frgs. (LPT coll., Rome). Libyan coasts 1 sh.; It-Trozz (Malta Is.), bioclastic sand sample 130 m, 1 sh. (RV coll., Rome). Northeast Atlantic: Pta. De Teno, (Tenerife Is., Canary Islands), bioclastic sand sample 27 m, 2 shs. (LPT coll., Rome); Punta Blanca (Puerto Santiago, Tenerife Is., Canary Islands), bioclastic sand sample 30 m, 9 shs. (LPT coll., Rome); West Sahara, 24°-25° N, stomach contents of flatfishes (Fam. Pleuronectidae) 16 spms./shs. (Italo Nofroni, Mauro Pizzini and LPT colls., Rome). Italian fossil deposits: Taranto (Southeast Italy, probably Pleistocene), 1 sh. labelled as «*Cylichna cuneata*» by Tiberi (Monterosato coll., box 16118); Gravina, (Southeast Italy, probably Pleistocene), 1 sh. labelled as «*Cylichna cuneata*» by Tiberi (Monterosato coll., box 16118);

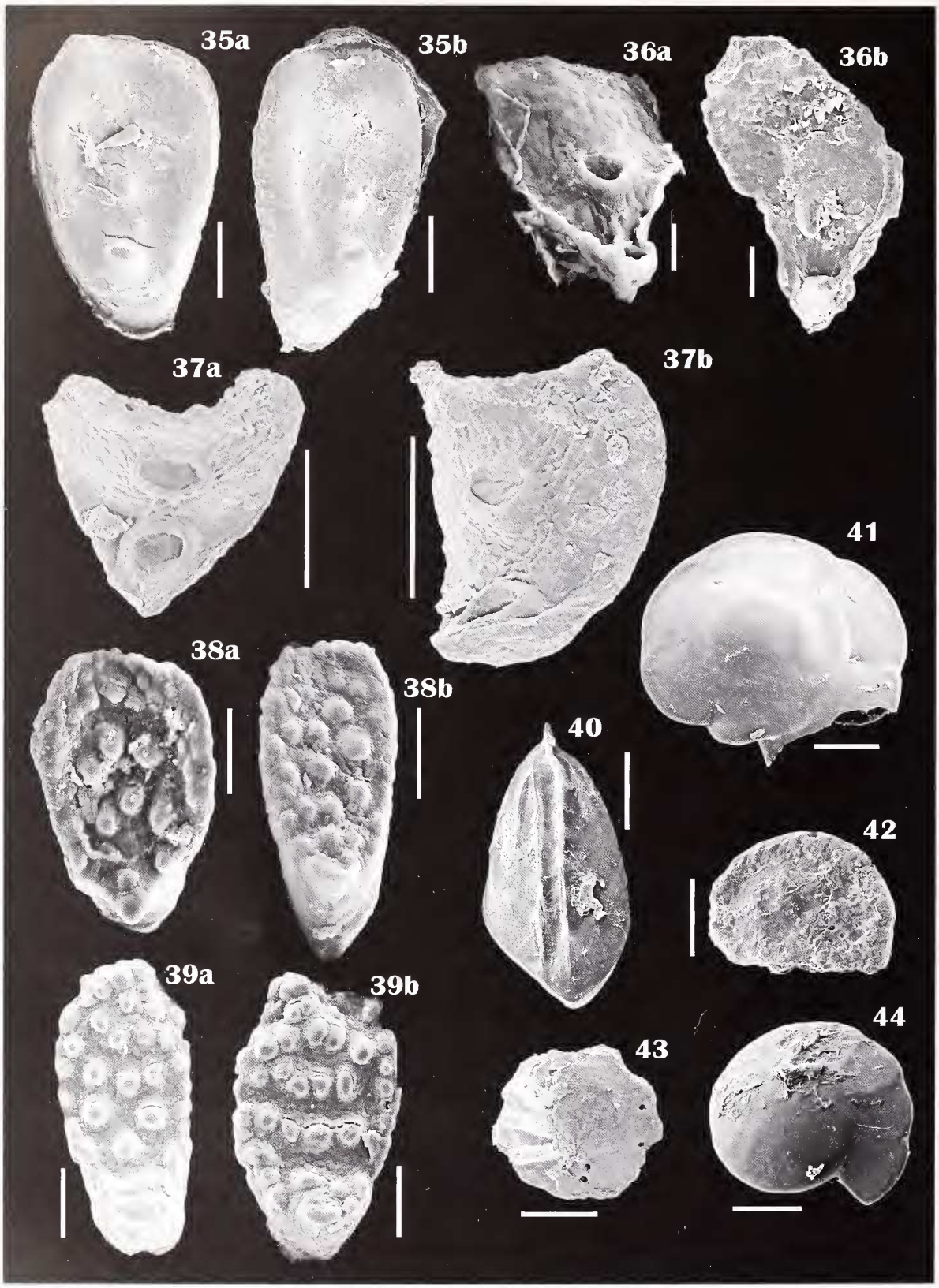
Remarks - The identity, nomenclature, systematic position, and geographic range of this species has been already discussed elsewhere (TRINGALI, 1993; 1995).

The shell of *Pyrunculus hoernesii* is more slender and evenly conical than *P. ovatus*, with quite flat sides, less variable in outline, and of more moderate size (height up to 5-6 mm, but usually smaller). It is quite characteristic in its weak axial ribs, evident on the top "crown", and gradually vanishing downward. Such an axial sculpture recalls that of *Retusa truncatula* (Bruguière; 1792), yet the nearly shining surface of fresh shells is also run by simple spiral lines, which are nearly lacking on the middle, and more closely spaced toward the base. Two more marked spiral lines run just below the top. Conical shells of *R. truncatula* show a weak, rounded recess just above the middle, that gives a more sinuous outline to the shell, never seen in *P. hoernesii*.

The morphology of gizzard plates (Figs. 37a-b) proves *P. hoernesii* to be a *Pyrunculus* (cf. TRINGALI, 1993: 26; 28, figs. 3-7; MORENO & TEMPLADO, 1998: 51, figs. 22-23). Observed through the SEM some unpaired plates displayed evident cavities inside the tubercles. Being dry preparations for the SEM, we can not rule it out that these cavities could be artefacts due to dehydration. As *P. ovatus*, it feeds on foraminiferans (Fig. 49).

Pyrunculus hoernesii inhabits sandy-muddy bottoms from shallow waters down to the upper slope (300-400 m ca.), in the whole Mediterranean basin, possibly being more frequent along the Southern coasts. It lives also in the neighbouring Atlantic waters (Northwest Africa: DAUTZENBERG, 1917: 65; PALLARY, 1920: 20; TRINGALI, 1993: 24; West Spain: SYKES, 1904: 36; Canary Islands: TRINGALI, 1995). It is a rather common species within its range.

WEINKAUFF (1866: 238) introduced the name *Bulla hoernesii* in an addition to his check-list of the Algerian marine molluscs, by a reference to two drawings published by HÖRNES (1856: 620; pl. 50, figs. 4a-b) as «*Bulla conulus* Deshayes, 1824». We have not examined the fossil shell sketched by HÖRNES (1856). They have the status of type material by means of WEINKAUFF's (1866) reference, according to the ICZN (1999: Art. 72.4). It is difficult to say whether the Recent material from Algiers which Weinkauff had in his hands really matches that Tertiary material from the Vienna Basin. The figured shell is similar to *P. hoernesii*, yet it shows more marked and close set axial and spiral sculpture, and it seems closer to the fossil shell from Altavilla Milicia (Palermo, Sicily) here figured (Fig. 15). Anyway, as in the case of *Cylichna ovata*, we consider that the Algerian shells in Weinkauff's hands were decisive to establish the introduction of a new species, and therefore belong to the type material of *P. hoernesii*. After the common usage of Weinkauff's name in recent literature for the species herein discussed, the selection of a lectotype among Weinkauff's material would be desirable to stabilise the identity of the name. We avoid the designation as lectotype of the single syntype in the ZMR, preferring a selection from the material, probably richer, in the USNM, where the Weinkauff coll. arrived as a part of the Jeffreys coll.



Figs. 35-44. Retusid gizzard plates and preyed foraminiferans - **Figs. 35a-b**: *P. ovatus* (Jeffreys), paired pls., Mauritania, 900-1200 m (from the shell in Fig. 11), **Figs. 36a-b**: *P. fourierii* (Audouin), Monoa Bay (Palawan Is., Philippines), coral reef sediment 11 m (a: unpaired g. pl.; b: paired g. pl.; from a shell with a h: 1.5 mm ca.) ; **Figs. 37a-b**: *P. hoernesii* (Weinkauff), unpaired pl., two different views, West Sahara (data as Figs. 21a-b, from a shell with a h: 2 mm ca.), **Figs. 38a-b**: *R. mamillata* (Philippi), Stn. AKD.92-22 (a: unpaired g. pl.; b: paired g. pl.; from a shell with a h: 2.5 mm ca.); **Figs. 39a-b**: *R. desgenettii* (Audouin), Marsa Fijab (Sudan), beached (a: paired g. pl.; b: unpaired g. pl.; from a shell with a h: 2 mm ca.); **Figs. 40-44**: foraminiferan tests from the gizzard contents of *P. ovatus* (Jeffreys), Mauritania, 900-1200 m (from the shell in Fig. 11) - **Scale bars**: 100 µm (35a-b, 37a-b, 40, 41, 42, 43, 44); 20 µm (36a-b); 50 µm (38a-b; 39a-b).

Despite that this species has been frequently identified as *Bulla striatula* Forbes, 1844 (e.g. Monterosato, 1884: 142), this name cannot be employed, because the original description (Forbes, 1844: 188), and the drawing of a «type» (a syntype, or the holotype?) found in the British Museum published by Sykes (1904: pl. III, fig. 3) do not apply to the species herein discussed. It is likely that *Bulla striatula* is a junior synonym of *Retusa mamillata* (Philippi, 1836) (Jeffreys, 1867: 421; see also Tringali, 1993: 24), although Sykes (1904: 37) noticed that the type has a rather sunken protoconch, not showed on the drawing. *Retusa mamillata* (Philippi, 1836) is a valid Northeast Atlantic-Mediterranean species, not a simple form of *Retusa truncatula* (Bruguière, 1792) as erroneously suggested by Lemche (1948: 55). It has a very variable spire, ranging from a *Tornatina*-like prominence to a somewhat deep immersion (Figs. 51-52). In fact Sykes (1904) did not contend that the type of *Bulla striatula* could be *R. mamillata*, and anyway noticed that it was not the same of *P. hoernesii*, as it is evident. More recently Grossu (1986: 429-430, figs. 198a-b) and other East European authors adopted the name «*Retusa (Coleophysis) striatula* (Forbes)» for a form related to *R. truncatula*, a view on which we disagree.

Cylichna cuneata Tiberi, 1868, applies also to *P. hoernesii*, as Tiberi himself noticed when placing a new label on the box where his material of *C. cuneata* is kept (he considered, in turn, *P. hoernesii* a synonym of the Chinese *Bulla pyramidata* A. Adams, 1850). *C. cuneata* was introduced with a clear description based on a single shell or specimen from the Gulf of Naples. The holotype was not marked by Tiberi. The material of Tiberi, now in the Monterosato coll., includes many mixed shells/specimens from the Gulf of Naples, all conspecific, labelled by Tiberi as «*Cylichna cuneiformis*» (obviously the manuscript name originally employed by Tiberi before the original description) kept all together in a tube. Thus, it can not be decided which is the holotype, but the identity of *C. cuneata* is evident. More problematic is the relationship with the Western Atlantic *Cylichna caelata* K.J. Bush, 1885, described from Cape Hatteras (North Carolina, East U.S.A.), and ascribed to *Pyrunculus* by Pilsbry (1895). De Jong & Coomans (1988: 209, fig. 693) published under the name «*Cylichna caelata* Busch», the SEM photo of a shell from Suriname which has a shape closely similar to *P. hoernesii*. However, the spiral lines of *Pyrunculus caelatus*, described by Bush (1885) as «punctate» ("pitted"), do not fit the simple spiral lines of *P. hoernesii*.

Pyrunculus fourierii (Audouin, 1827)
(Figs. 23-26, 30, 36a-b, 47)

- *Bulla fourierii* Audouin 1827 (: 178)
- (?) *Bulla decussata* A. Adams, 1850 (: 595; pl. CXXV, fig. 147)
- (?) *Utriculus simillimus* R.B. Watson, 1883 (: 340)
- (?) *Cylichna protumida* Hedley, 1903 (: 396-397; fig. 112)
- *Retusa dilatata* Pallary, 1904, sensu Bogi & Khairallah (1987: 56)
- *Retusa dilatata* var. *minor* Pallary, 1904, sensu Bogi & Khairallah (1987: 56)

Material examined - Type material: *B. fourierii*, not examined; the holotype (MNHN) is figured by a SEM photo in Bouchet & Danrigal (1982: 20, fig.54). *Bulla decussata*: not examined (probably NHML). *Utriculus simillimus*: not examined (probably NHML). *Cylichna protumida*: not examined (probably AMS). **Other material:** Eastern Mediterranean: Soguksu (Aydincik, Southern Turkey), *Posidonia* intermatte's sediment 9 m, 15 shs. (Raimondo Villa and LPT colls., Rome), and 10 m, 3 shs. (LPT coll., Rome); Kash (Southern Turkey, AKD'92 exp., see Oliverio et alii., 1993), Stn. AKD-22, bioclastic sand sample 34 m, 6 shs. Indo-Pacific: "La Grand Baie" beach (Mauritius Is.), coral reef sediment 2 m, 1 sh. (LPT coll., Rome); Pee-Pee Is. (Andaman Islands), coral reef sediment 30 m, 1 sh. (LPT coll., Rome); Honda Bay (Palawan Is., Philippines), coral reef sediment 11 m, 3 partially preserved spm. + 30 shs. (IN coll., Rome); Northern coast of Green Is. (Queensland, Australia), coral reef sediment 3-4 m, 2 sh. (LPT coll., Rome).

Remarks - The name *Bulla fourierii* was introduced by reference to a drawing on the plates on Egyptian molluscs by J.-C. Savigny (see also Pallary, 1926: pl. IX, fig. 6), and has been employed, with very few exceptions, in the Red Sea literature, and, more recently, in some Mediterranean works. However, this species is widespread through the Indo-West Pacific Region. We examined a scarce Indo-Pacific material of *P. fourierii*, yet from quite far localities. Some names are probably junior synonyms of *P. fourierii*. The Australian *Utriculus simillimus* Watson, 1883, and *Cylichna protumida* Hedley, 1903, seem to belong to this species after the original description and drawings; for *U. simillimus*, probably based on subadult shells, see also the drawing in Watson (1886: pl. XLIX, figs. 2b-c). The original description and drawing of the Chinese *Bulla decussata* A. Adams, 1850, is less clear. However Kuroda & Habe (1954: pl. 2, fig. 5) published a photo of a shell of *B. decussata* recovered in the P. Carpenter coll. (Redpath Museum of McGill Univ., Montreal) much probably donated by A. Adams himself, which obviously fits *P. fourierii* shell morphology. Although this is not a syntype, originating from Japan, *Bulla decussata* is arguably a synonym of *P. fourierii*. As we have not examined their types, the listed synonyms need to be confirmed. Further names (also reported by Kuroda & Habe, 1954: 7) should be checked as possible synyonyms of this species.

Sharing Gaglini's (1991: 5) view, we find untenable the synonymy of *P. fourierii* with both *Retusa dilatata* Pallary, 1904, and *Retusa dilatata* var. *minor* Pallary, 1904, proposed by Bogi & Khairallah (1987: 56). Pallary (1904: 215-216; pl. VII, fig. 8) described *R. dilatata* and its variery *minor* from Sfax (Tunisia), thus from a part of the Mediterranean where there were hardly any Lessepsian migrants by 1900. The examination of some syntype of both forms (Fig. 27, 48a-b) conserved in the Monterosato (box 16049, ZMR), and in the F. Settepassi colls. (no catalogue number, ZMR), shows that *R. dilatata* and its variety *minor* are closely related to *Retusa truncatula* (Bruguière, 1792), possibly a large sized form, with a height up to 7 mm.

Recorded for the Suez Canal (Moazzo, 1939: 133-134), this species has entered the Eastern Mediterranean basin as a Lessepsian migrant - on the concept of «Lessepsian migration» see Por (1978: in particular 87 and following pp.), and Oliverio (1995: 36) – spreading through the Levant Sea. After the first Mediterranean record by Bogi & Khairallah (1987: 56; 60, fig. 5) from the Bay of Jounieh (Lebanon), *P. fourierii* was also recorded along the Mediterranean coasts of Israel, Cyprus Is., and Southern Turkey (e.g. Aartsen et alii, 1989: 71; Buzzurro & Greppi, 1996: 8; Cecalupo & Quadri, 1996: 110; Engl, 1992: 8; 1995: 46;

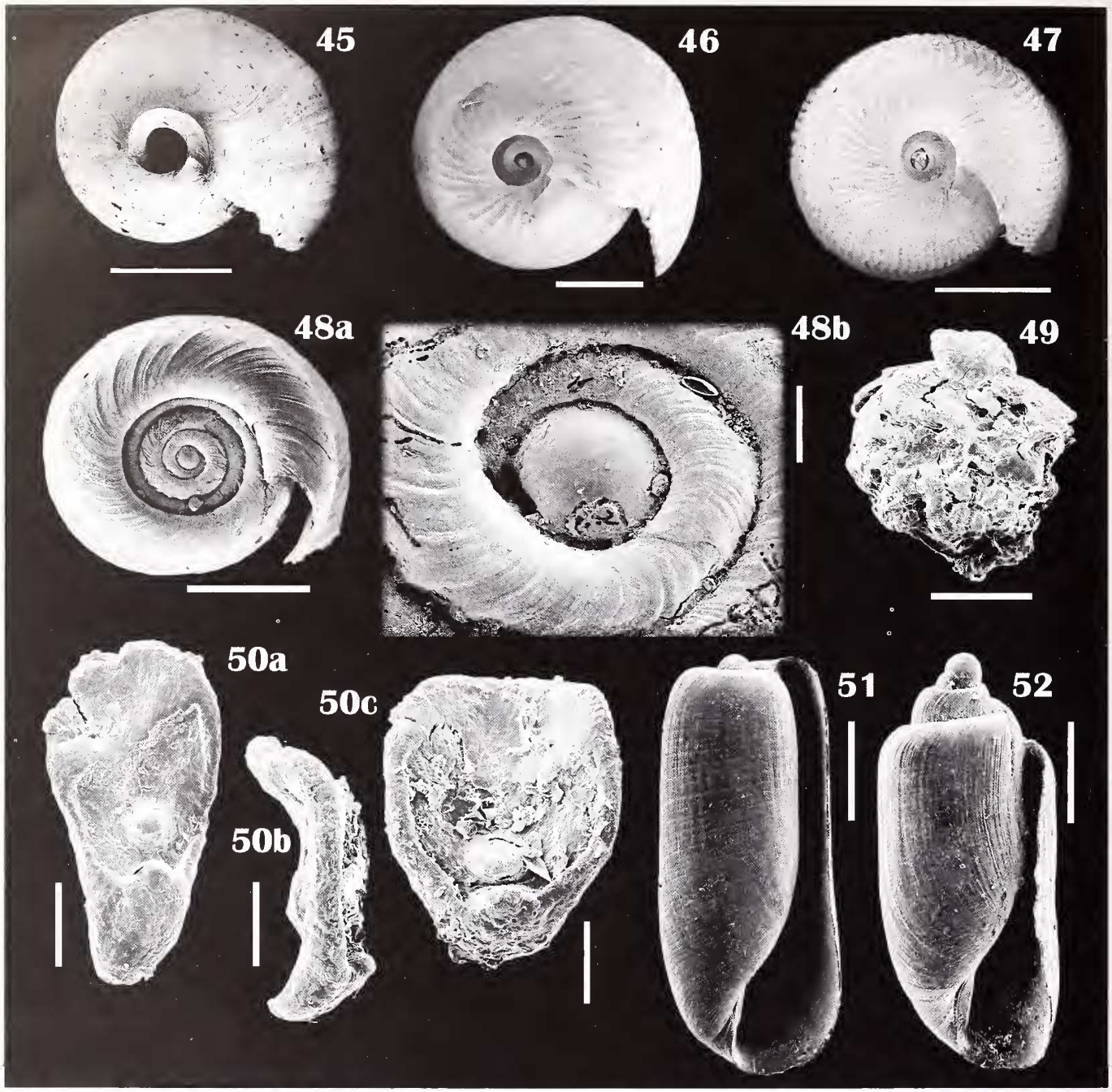


Fig. 45: *P. ovatus* (Jeffreys), syntype of *Cylichna obesiuscula* Brugnone, same shell in Figs. 3a-b, upper view. **Fig. 46**: *P. hoernesii* (Weinkauff), labelled as «*Cylichna cuneata*» by Tiberi, Gulf of Naples (Monterosato coll.), upper view. **Fig. 47**: *P. fourierii* (Audouin), same shell in Figs. 23a-b, upper view. **Figs. 48a-b**: *Retusa dilatata* Pallary, syntype, same shell in Fig. 27, upper view and protoconch. **Fig. 49**: foraminiferan test from the gizzard contents of *P. hoernesii* (Weinkauff), in a specimen labelled as «*Cylichna cuneata*» by Tiberi, Gulf of Naples (Monterosato coll.). **Figs. 50a-c**: *P. hoernesii* (Weinkauff), gizzard plates from a specimen labelled as «*Cylichna cuneata*» by Tiberi, Gulf of Naples (Monterosato coll.) (a: paired g. pl.; b: paired g. pl., lateral view; c: unpaired g. pl.). **Figs. 51-52**: *Retusa mamillata* (Philippi), Stn. AKD.92-No. 22, Kash (Turkey), bioclastic sand sample 34 m. – **Scale bars**: 1.0 mm (45, 48a); 500 µm (46, 47, 51, 52); 200 µm (49); 100 µm (48b, 50a-c).

Tringali & Villa, 1990: 35, 37). It has never been recorded alive in the Mediterranean, yet we have observed scanty residues of soft parts – few brownish spots visible through the shell – inside some shells from Kash and Soguksu (Southern Turkey).

The authors who quoted *P. fourierii* mostly ascribed it to the genus *Retusa*: that is the case of all Mediterranean records, as well as of Dautzenberg (1929: 126 or 332), Moazzo (1939: 133), Pallary (1926: 75), Sabelli et alii (1990-1992), and Vine (1986: 175). The exception is Pilsbry (1895: 311-312), who adopted *Cylichna* Lovén, 1846. Actually, the shell morphology does not allow to give the species a position within *Pyrunculus*, being more similar to *Retusa*: for instance the slightly pear-shaped outline of *P. fourierii*, with its deeply sunken spire, is not dissimilar from that of the Red Sea *Retusa desgenettii* (Audouin, 1827) (Figs. 31a-b), which also shares with *P. fourierii* the same sculpture of close set of spiral and growth lines, crossing each other resulting in a well marked network, shining on

fresh shells under the light. However, a comparison of the gizzard plates proves that *P. fourierii* belongs to *Pyrunculus*, whereas *R. desgenettii* is a true *Retusa* (cf. Figs. 36a-b, 39a-b). We examined dry residues of a damaged specimen of *P. fourierii* from Philippines still keeping two plates only: the SEM photos are unfortunately not good, nevertheless the couple of large tubercles on the plates is evident. Each tubercle of the dry unpaired plate shows a cavity as those noticed for *P. hoernesii*.

CONCLUSIONS

Very few species of *Pyrunculus* are known in the Northeast Atlantic-Mediterranean waters. The genus was omitted by SETTEPASSI et alii (1976), whereas of the two species quoted by PIANI (1980), BRUSCHI et alii (1985), SABELLI et alii (1990-1992), BEDULLI et alii (1995), only *P. ovatus* has been retained here as a Mediterranean *Pyrunculus*. *Utriculus minutissimus* has been moved to *Retusa*. On the other hand, *P. hoernesii* and *P. fourierii* have been removed respectively from *Cylichna* and *Retusa* to be added to the list of Mediterranean *Pyrunculus*.

The occurrence of *P. ovatus* as living in the Mediterranean Sea is still to prove: all records may be based on fossils. Also *P. fourierii* has not been recorded on living specimens so far (SABELLI et alii, 1990-1992: 423), although the large number of shells suggests its acclimatisation in the Levant Sea.

The selection of a lectotype for *Bulla hoernesii* among Weinkauff's material in a next future is strongly recommended in order to definitely set the use of this name. Finally, some names have to be checked as synonyms of *P. fourierii* and *P. hoernesii* after examination of the relevant type material.

Much investigation is still needed to gain a more comprehensive knowledge on the systematics of the Northeast Atlantic-Mediterranean retusid gastropods. Retusidae seems to be one of the cephalaspidean groups where shell morphology is least helpful to define both specific and supraspecific systematics. This fact emerges also in the present work, considering the problematic reference of species to distinct retusid genera after studying the shell morphology alone, as is shown by the case of *P. fourierii*.

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